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Pilot scale electrodialytic treatment of MSWI APC residue to decrease leaching of toxic metals and salts

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A major challenge of municipal solid waste incineration (MSWI) technology is the residue generated during the burning, and especially the air pollution control (APC) residue. In Denmark, incineration with energy recovery is the chosen strategy for handling municipal solid waste except for a few fractions like glass, paper, cardboard, metal and hazardous waste which is sorted out at the source. Around 100,000 ton of APC residue is produced annually and exported as hazardous waste to Norway and Germany. The hazard arises from high amounts of mobile toxic elements, salts as well as trace quantities of very toxic organic compounds and the highly alkaline pH.

Electrodialysis of semidry APC residue has shown potential for reduction of leaching of toxic elements and salts [1,2] to produce a material feasible for substitution of cement in mortar [3]. During the electrodialytic process, elements of potential value are concentrated in the concentrate stream which implies a reduction in the volume of hazardous material and a potential for regeneration.

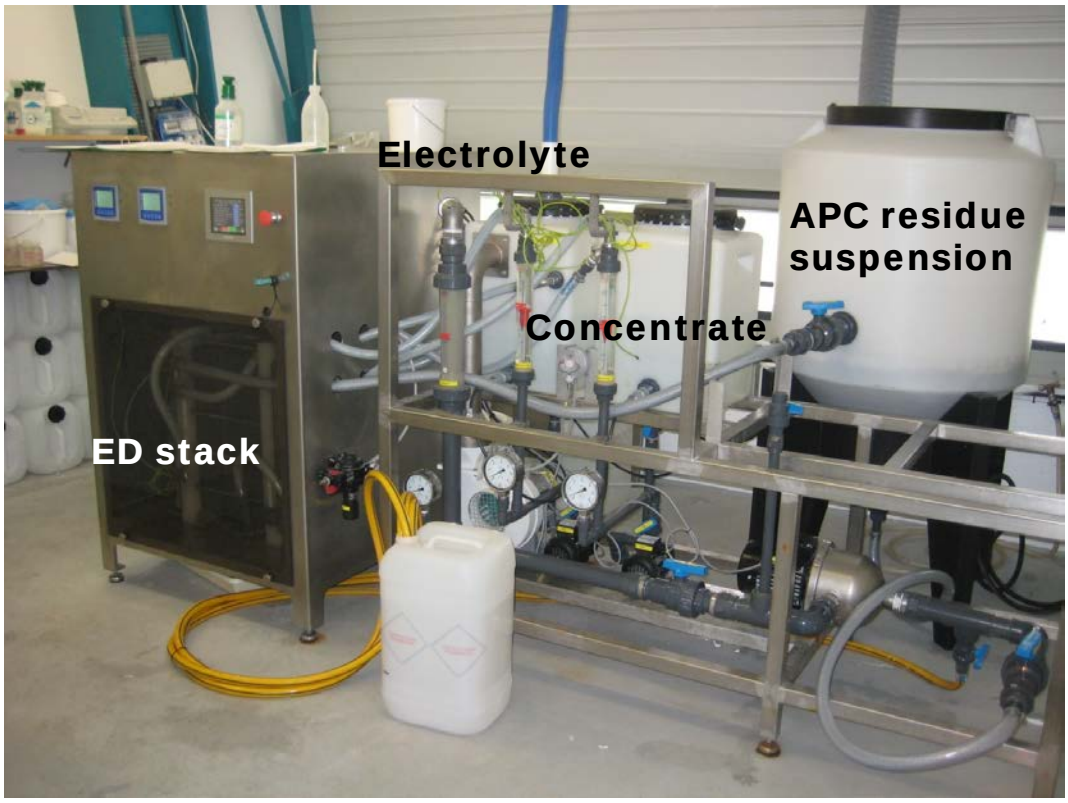

Figure 1 Experimental setup

In this work, results of 23 pilot-scale treatments in an electrodialytic stack setup (figure 1) are reported. The experimental span is described in table 1. In all the experiments L/S

10 was kept for the suspension (5.3 or 8 kg APC residue and 53 or 80 l water were mixed), and the suspension continuously treated for up to 24 hours in an electrodialytic stack. Experiments were made with APC residues from dry, semidry and wet fluegas cleaning system, as well as carbonated and pre-washed semidry APC residue. Sampling was made regularly (every or every second hour) during treatment. Current density (0 – 11.3 mA/cm^2), different batch samples and aeration were varied to reveal optimal treatment conditions and stability of the process.

Table 1. List of experiments

APC residue	No. experiments	Investigated parameters
Dry	2	Current density
Semidry	15	Current density, batch influence, aeration
Semidry- carbonated	2	Carbonation pretreatment
Semidry-washed	1	Washing pretreatment
Wet	3	Current density, batch influence

Significant reduction in leaching of the critical elements Pb, Zn and Cl was obtained. Leaching reduction depended somewhat on current density and treatment time, as a high current density and long residence time gave operational problems in the set-up. Type of pretreatment and type of APC residue also influence the remediation potential.

References

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